

SOME PELAGIC MOLLUSCS AND ASSOCIATED ANIMALS IN SOUTH-EASTERN AUSTRALIAN WATERS

By ISOBEL BENNETT*

Pls. 8-13.

Offshore, along the coast of New South Wales, there is a warm southward-flowing current in which many of the pelagic animals of the high seas are to be found. Each year, during the summer months (October to February), the prevailing winds are from the north-east, and when these have been blowing strongly and continuously for several days at a time, many oceanic species are blown shorewards, and on occasions the coastline may be strewn with dead or dying animals of different kinds.

The greater bulk of these belong to the Cnidarian Order, Siphonophora, with the Portugese Man-of-war, *Physalia utriculus* Eschscholtz, 1829, being the most numerous, so much so that at times it causes havoc among the swimmers on surf beaches. In some years its relative, the By-the-wind Sailor, *Velella lata* Chamisso and Eysenhardt, 1821, also occurs in large numbers, and less frequently a third species, *Porpita pacifica* Lesson, 1826, is found among the flotsam and jetsam along the ocean tidelines. On January 22nd, 1964, this last species formed the bulk of the animals being cast up on some Sydney beaches, but this is an unusual occurrence.

Nearly always associated with one or more of the above are three or four species of molluscs which prey upon them, the two most obvious being the purple snails belonging to the genus *Janthina*†. The other two species are pelagic nudibranchs, *Glaucus* and *Fiona*.

Bayer (1963) has described a similar association along the eastern coast of Florida where the animals are blown ashore from the Gulf Stream. Morton (1954) records the association found in the Benguela Current off the coast of south-west Africa. Bieri (1961) has suggested a correlation between food supply, seasonal occurrence, and reproductive cycle in *Velella lata*, which could possibly have the same kind of significance in other members of this pelagic community.

CLASS GASTROPODA SUB-CLASS PROSOBRANCHIA ORDER MESOGASTROPODA FAMILY JANTHINIDAE

Janthina janthina (Linné).

Helix janthina Linné, 1758, *Syst. Nat.*, 10 ed., 1, p. 772.

Janthina violacea Röding, 1798, *Mus. Bolten.*, 2, p. 75.

Janthina planospirata A. Adams and Reeve, 1850, *Zool. Voy. Samarang*, p. 54, pl. 11, fig. 10.

* School of Biological Sciences, University of Sydney.

† This name is spelt with an initial "J" in the original publication, although many modern workers use "I", presumably following Laursen's (1953) Monograph.

Allan (1950) records four species of the family Janthinidae from New South Wales waters, Iredale and McMichael (1962) record five species, and Macpherson and Gabriel (1962) refer to two definite species from Victorian waters, and mention other names recorded in the literature. Two species are figured in May's (1958) list for Tasmania.

Laursen (1953) placed all the then known species of the genus *Janthina* into the synonymy of five species, using radula teeth and ontogenetic conditions of the animals themselves rather than shell pattern to differentiate them. On the basis of his classification, all five species are distributed throughout the Pacific, Indian and Atlantic Oceans. Laursen has reduced all viviparous animals with trochoid shell to the species, *Janthina janthina* (Linné). In all other species the shell is globose, and the animals oviparous.

During the last 20 years, the animal most often collected in New South Wales waters by the author, and the shell which also forms the bulk of the Australian Museum collection, is that which has generally been referred to as *J. violacea* Röding, 1798. In making a comparison of the shells in the collection with Laursen's description, no significant difference could be found, and the species is definitely viviparous (Pl. 8, figs. 2, 3, which is a photograph of an animal washed ashore at Bondi, N.S.W., on January 4th, 1965).

Bayer (1963) and Wilson and Wilson (1956) have given a number of interesting facts regarding the biology of this species.

Very large shells of this species in the Australian Museum collection were blown ashore at Lord Howe Island in October-November, 1950. The largest measured 46.5 mm. in diameter and 39.5 mm. in height.

When these animals are blown ashore on ocean beaches they are, in most instances, bashed by the surf and the float is seldom found intact. On January 14th, 1965, however, over 300 animals were collected alive, all with the float attached, on the western shore of Botany Bay, where they had been gently floated on to a surfless beach (Pl. 8, fig. 1). *Physalia*, *Velella* and *Porpita*, and the nudibranch, *Glaucus*, were collected with them.

Janthina prolongata Blainville.

Janthina prolongata Blainville, 1822, *Dict. Sci. Nat.* 24, p. 155.

Janthina globosa Swainson, 1826, *Zool. Illus.*, 2, pl. 85 (non *globosa* Blainville, 1825).

The second conspicuous species occurring along the coast, a very globose shell of uniform violet colour, often with a mass of egg capsules along the float, agrees with Laursen's diagnosis of *J. prolongata*. (Pl. 9, fig. 1; Pl. 10, fig. 1.)

Janthina exigua Lamarck.

Janthina exigua Lamarck, 1816, *Ency. Méth.* (Vers), pl. 456, figs. 2a and b, Liste, p. 12.

Janthina capreolata Montrouzier, 1859, *J. Conchyliol.*, 8, p. 375.

Shells belonging to this species have previously been referred to the genus *Iodina* Mörch, 1860, *J. Conchyliol.*, 8, p. 282. Shells in the Australian Museum collection are strongly sculptured with V-shaped ridges, the apex of the V's forming a peripheral furrow. (Pl. 9, fig. 2.)

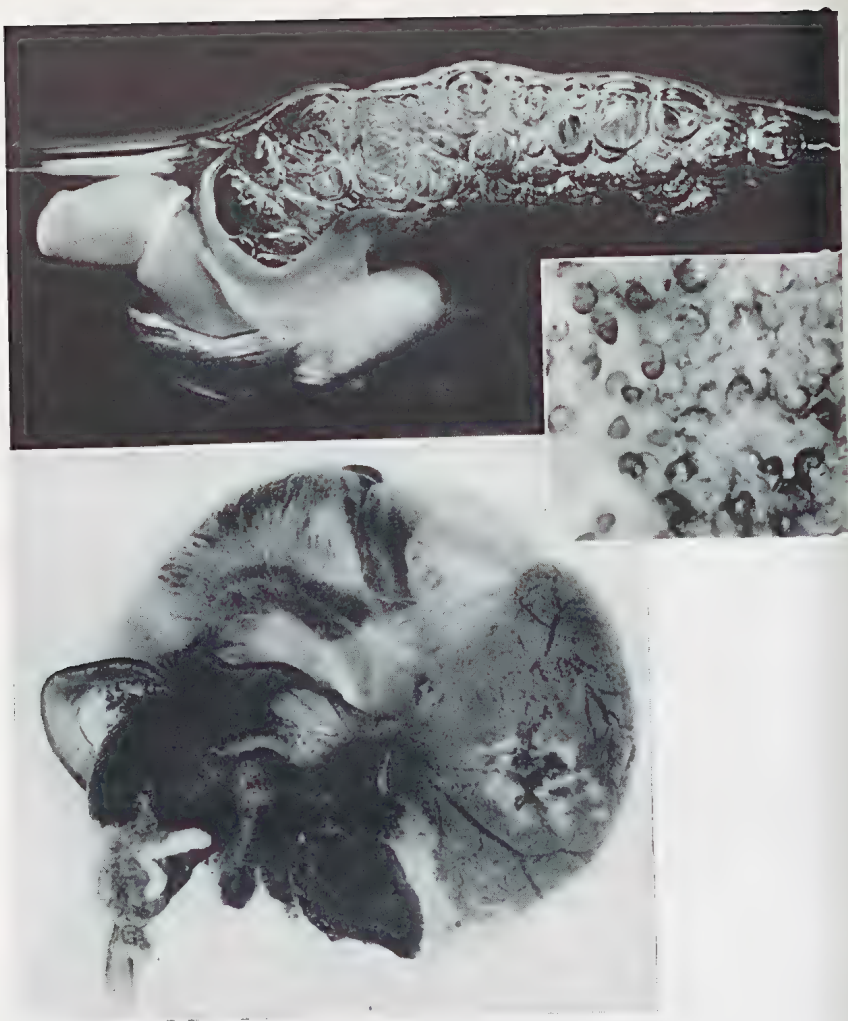


PLATE 8

- (1) *Janthina janthina*—living animal with float attached, washed ashore Botany Bay, N.S.W., January, 1965.

Photograph: Mr. Justice F. G. Myers.

- (2) *J. janthina*—animal removed from shell, washed ashore Bondi Beach, N.S.W., 4th January, 1965. The light patch in the lower right segment of the animal marks the region where the outer layer of tissue was removed to take the inset photo.

- (3) *J. janthina*—veliger larvae with well-developed shells were present in the ovary in large numbers. X 20.

Photographs: Dept. of Illustration, University of Sydney.

Janthina umbilicata D'Orbigny.

Janthina umbilicata D'Orbigny, 1840, *Voy. Amér. Mérid.* No. 319.

Janthina nitida Adams, 1869, *Proc. Zool. Soc. Lond.*, 1868, p. 620.

Laursen has referred this species to the synonymy of *J. exigua* Lamarck. It has not been possible to obtain living or preserved animals with floats and egg capsules to compare these with Laursen's description, but in all the specimens in the Australian Museum collection referred to this species, the shell is different to that of *J. exigua*, being much smoother. Although there is one record of occurrence as far south as Bermagui in southern New South Wales, the greater number of shells in the collection are from warmer northern waters of the coast and islands surrounding the Coral Sea.

FAMILY RECLUZIIDAE

Recluzia rollandiana Petit.

Recluzia rollandiana Petit, 1853, *J. Conchyliol.*, 4, pp. 119-120, pl. 5, fig. 2.

The small collection of shells in the Australian Museum consists of two species belonging to this family, one of which, a high spired form, was named *R. hargravesi* Cox, from Port Stephens, N.S.W. This could be synonymous with the species recorded from the Indian Ocean and commonly known as *R. johnii* Chemnitz. However, it has not been possible to determine the correct name of the latter.

The second species, in which the shell is more swollen with a relatively lower spire and produced columella, appears identical with Petit's *R. rollandiana* and the animal illustrated (Pl. 11, fig. 1) is the first record of this species from New South Wales.

There are also specimens of this shell in the Australian Museum from Catherine Hill Bay, N.S.W., and Caloundra, Queensland. The name *R. lutea* Bennett, 1840 (*Narr. Whaling Voy.* 2, p. 63 and p. 298), has sometimes been used for this species but the description is so meagre as to make its identity uncertain.

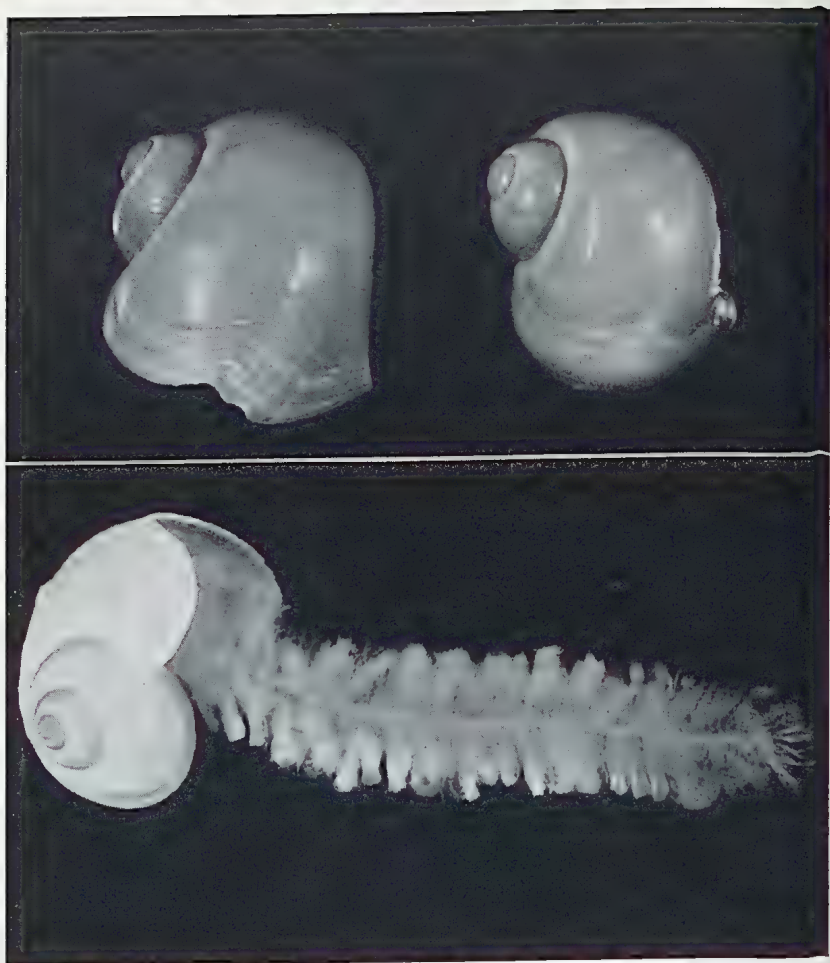


PLATE 9

- (1) *Janthina prolongata*—shells washed ashore, Long Reef, Collaroy, N.S.W., January, 1964.

Photograph: Mr. Justice Myers.

- (2) *Janthina exigua* (from the North Pacific)—with its unmistakable long narrow float covered with egg capsules. Veligers have already been freed from the distal capsules. (31°06' N. 130°06' W. 18th July, 1963.)

Photograph: Mr. Justice Myers.

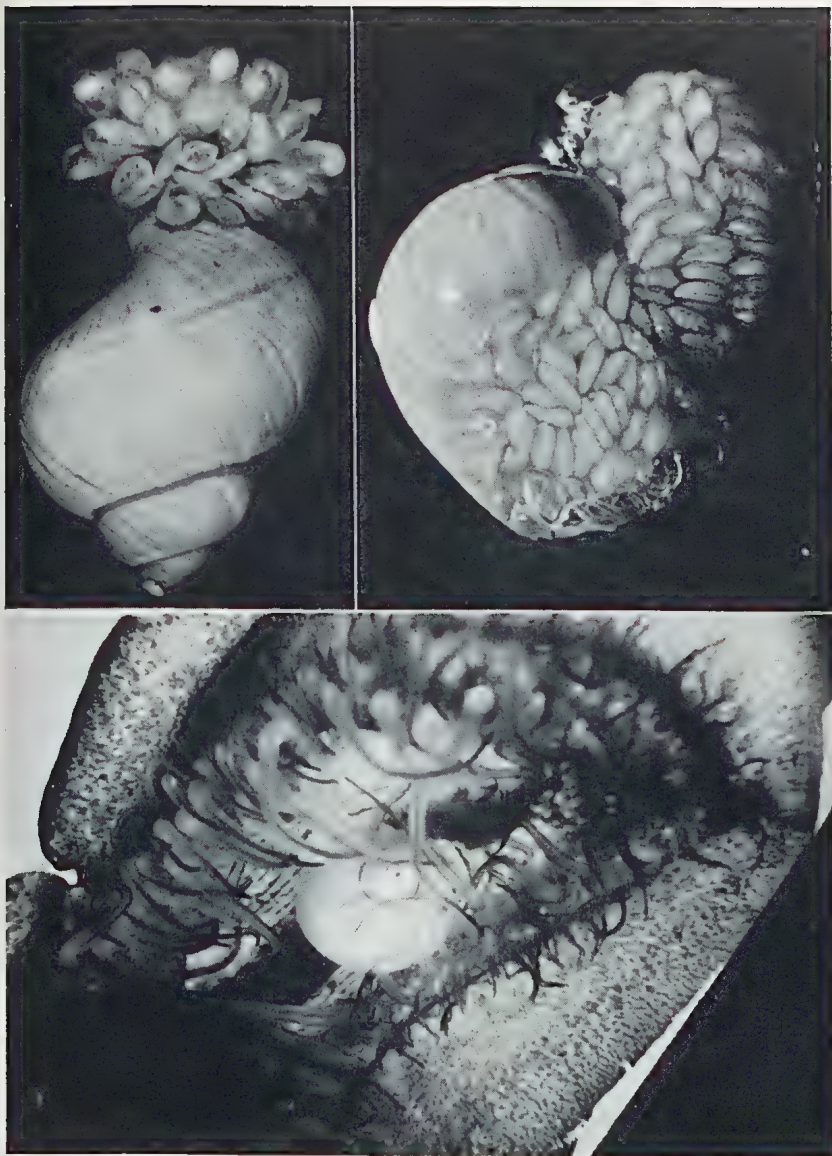


PLATE 10

- (1) *Janthina prolongata*—living animal with float, Sydney, N.S.W.
Photograph: Mr. Justice Myers.
- (2) *Janthina pallida* with its float and egg capsules which resemble those of *J. prolongata*. (31°06' N. 130°06' W. 18th July, 1963.)
Photograph: Michael Hadfield.
- (3) *J. pallida*—small animal (shell 1 cm.) without float, as it occurred on the underside of *Velella* in north Pacific waters, July, 1963.
Photograph: Paul Schroeder.

SUB-CLASS OPISTHOBRANCHIA
ORDER NUDIBRANCHIA
SUB-ORDER AEOLIDACEA
FAMILY FIONIDAE

Fiona pinnata Eschscholtz.

Fiona pinnata Eschscholtz, 1831, *Zool. Atlas*, 4, p. 14, pl. 19, fig. 1.
4, p. 14, pl. 19, fig. 1.

This species occurs sporadically along the coast of New South Wales. The author has never taken it as a free-swimming animal, but always on some floating object, usually one which has numbers of stalked barnacles. *Lepas* spp. attached to it. The slightly-coiled egg masses were found on bottles, cuttle bones and logs along with the adult *Fiona*.

FAMILY GLAUCIDAE

Glaucus atlanticus Forster.

Glaucus atlanticus Forster, 1777, *Voy. round World*, p. 49.

Glaucus lineatus Bergh, 1867, *K. Danske Vidensk. Selsk.* (5), 7, p. 147.

This species has been recorded from time to time in the Australian literature as *G. lineatus*. Mr. Robert Burn, who is systematically reviewing the Australian nudibranch fauna considers that this is merely the Pacific form of the Atlantic species, *G. atlanticus*.

Unlike *Fiona*, *Glaucus* is a free-living animal, living upside down on the surface film of the water. During heavy north-easterly weather in the last week of December, 1964, and the first week of January, 1965, enormous numbers of this animal were washed ashore on surfing beaches in the vicinity of Sydney. Several hundred were collected in a very short time on Warriewood Beach. They were accompanied by *Physalia* and *Janthina janthina*. In April, 1962, about 12 miles off Sydney, a number of specimens were caught with a dip-net in the surface waters where they were present in large numbers together with *Physalia* and *Velella*. Specimens kept alive in the laboratory for several days all laid strings of eggs.

CLASS CEPHALOPODA
SUB-CLASS COLEOIDEA
ORDER DECAPODA
FAMILY SPIRULIDAE

Spirula spirula (Linné).

Nautilus spirula Linné, 1758, *Syst. Nat.*, 10 ed., 1, p. 710.

The characteristic shells of *Spirula*, often with numbers of the small stalked barnacle, *Lepas pectinata* Spengler attached, are cast up sporadically along the coast, together with the animals mentioned above.

* It would be useful if an international decision could be made regarding the correct name by which this community should be designated. American writers use the term "Neuston" (presumably following P. S. Welch, *Limnology*, McGraw Hill, N.Y., 1952). P. M. David (*Endeavour*, 24, no. 92, May, 1965) uses the term "Pleuston" after A. I. Savilov (*Dokl. Ak. Nauk. S.S.S.R.*, 110, 3, 1956). From its Greek derivation (*pleustikos*—ready for sailing) this latter would seem an appropriate term, but unfortunately Welch specifically uses it for higher plants only.

NOTE ON THE OCCURRENCE OF A SIMILAR PELAGIC COMMUNITY IN THE NORTH PACIFIC OCEAN

In July, 1963, the author, whilst acting as a faculty member on board Stanford University's research vessel *TE VEGA*, noted the same kind of floating community* in northern Pacific waters about 300 miles west of the coast of California (Lat. 31° N., Long. 125° to 140° W.). Large *Velella* (ca. 9 cm. along the float) were first sighted on July 15th, the sea surface temperature being 18°C . For the next 36 hours the ship sailed through *Velella*, all the specimens caught with dip net being large and a very beautiful deep blue in colour. By the time the ship had reached longitude $127^{\circ}31'$ W. it was found that almost all animals caught had from one to five small *Janthina pallida* Thompson, feeding on the undersurface among the tentacles. It was also noted that none of these *Janthina* (some of the shells were up to 1 cm. in length) had begun to secrete floats. Some of the *Velella* also had small powder-blue stalked barnacles, *Lepas fascicularis* Ellis and Solander, attached to their floats, and on some the small blue pelagic crabs, *Planes cyaneus* Dana, were clinging. On others again, the nudibranch, *Fiona pinnata* Eschscholtz, was found. Floating objects such as fronds of seaweeds or pieces of wood were also picked up with colonies of larger lepadid barnacles, among which the small *Planes* were very numerous, together with varying numbers of *Fiona*. When this nudibranch occurred with these barnacles the colour was distinctly brown, presumably from the barnacles on which the animal was feeding. When *Fiona* occurred on *Velella* it was always blue in colour.

By July 18th, the size of individual specimens of *Velella* being caught had decreased considerably, and it was noted that most animals captured had one or more *Fiona* on them, and these appeared to keep to the upper surface of the *Velella*, but there were no *Janthina*. Several much larger *J. pallida*, now with floats, and several with egg capsules, were seen, and a second species, *Janthina exigua* Lamarck, was also noticed to be present in large numbers. It was significant, however, that this smaller species was not found on *Velella*, but always free-floating. Tiny individuals $\frac{1}{2}$ to 1 mm. in size had no float, but those from 2 to 3 mm. had already begun to secrete them. This was a distinctly different behaviour pattern from that of the larger species. The float was quite different in size, being long and narrow, and the egg capsules of mature individuals showed serial development along the float, from those nearest the animal with over 200 small white eggs to dark-coloured ones with shelled veligers clearly visible (Pl. 9, fig. 2). Several were hatched out whilst under observation in the ship's laboratory.

By late afternoon of the same day, living *Velella* were rarely seen, but large numbers of bare floats were taken, some with one to three or four *Fiona* attached, and nearly all bearing the characteristic coiled egg masses of the nudibranch (Pl. 12, fig. 2). A few small specimens of *Physalia*, *Porpita* and *Glaucus* were seen, but their occurrence was sporadic.

By July 20th, at longitude 135° W., the *Velella* were no longer being seen, although large numbers of minute *Janthina exigua* continued to be seen in the surface waters for the next two days.

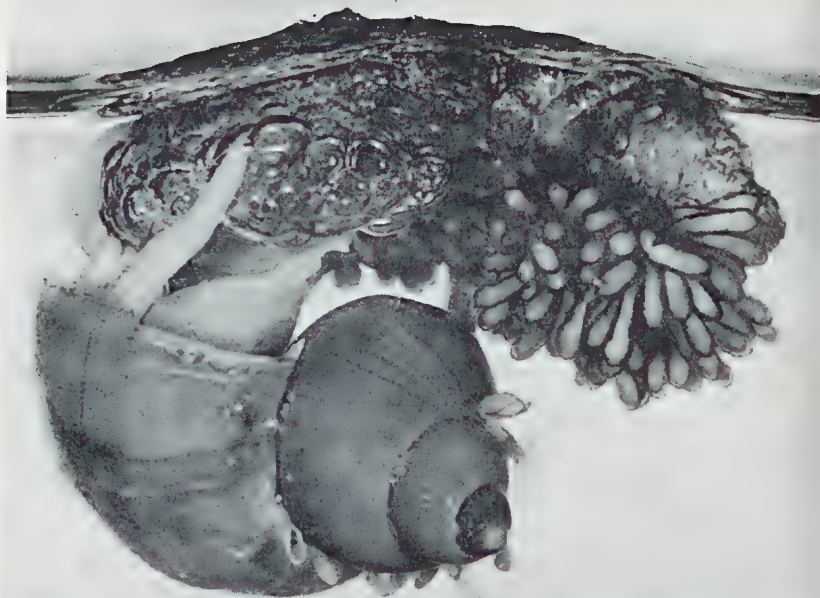


PLATE 11

- (1) *Recluzia rollandiana*—living animal with its float and egg capsules, Minnie Waters, northern N.S.W., April, 1964.

Photograph: Anthony Healy.

- (2) *Fiona pinnata*—living animal, removed from a floating, barnacle-encrusted log, Collaroy Beach, N.S.W., April, 1964.

Photograph: Mr. Justice Myers.

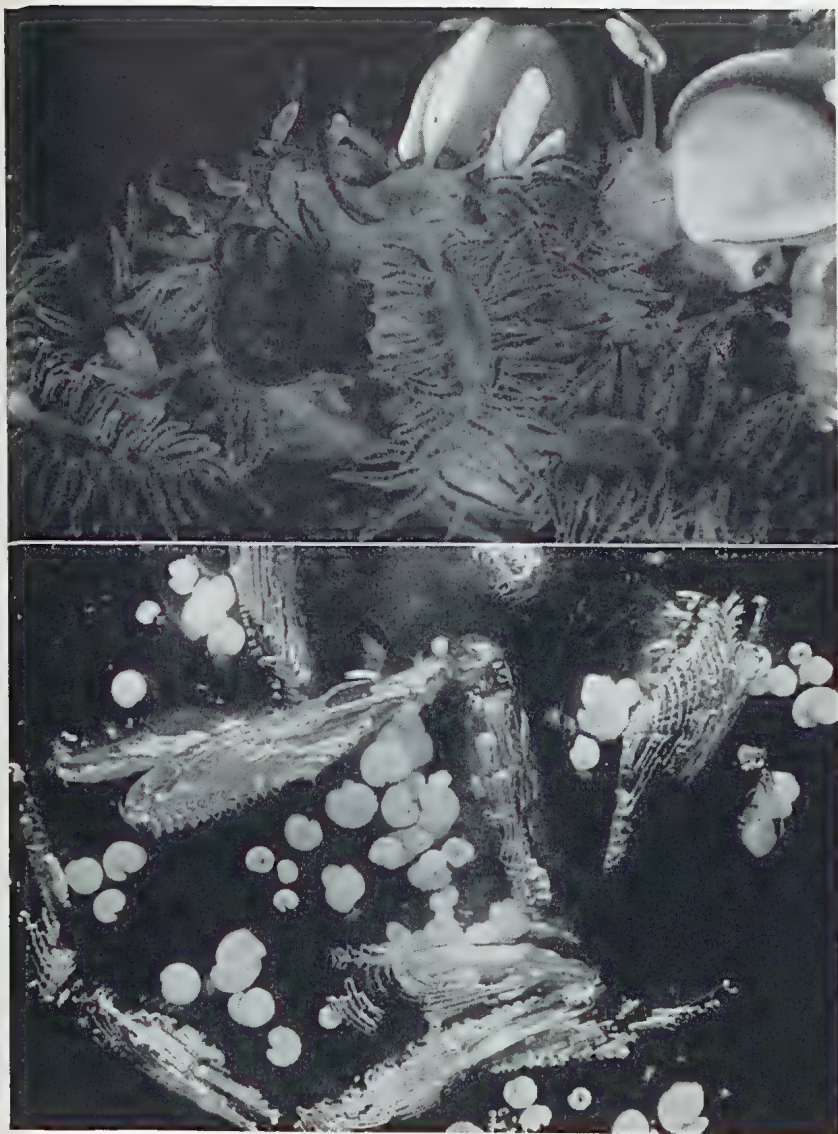


PLATE 12

- (1) A mass of *Fiona pinnata* feeding on barnacles, *Lepas anatifera*, on floating log washed ashore, Collaroy Beach, N.S.W., after a heavy storm, April, 1964.

Photograph: Mr. Justice Myers.

- (2) The slightly coiled egg masses of *Fiona pinnata* on *Velella* floats. (31°06' N. 130°06' W. 18th July, 1963.)

Photograph: Michael Hadfield.

ACKNOWLEDGEMENTS

I should like to acknowledge the help of Dr. D. F. McMichael, of the Australian Museum, for his critical reading of this manuscript, and Miss E. C. Pope, also of the Australian Museum, for checking the identifications of stalked barnacles. I should also like to thank the photographers whose names appear below the respective plates.

REFERENCES

- ALLAN, J., 1950. *Australian Shells*. Georgian House, Melbourne.
- BAYER, F. M., 1963. Observations on Pelagic Mollusks associated with the Siphonophores *Velella* and *Physalia*. *Bull. Mar. Sci. Gulf and Caribb.*, 13, No. 3.
- BIERI, R., 1961. Post-larval Food of the Pelagic Coelenterate, *Velella lata*. *Pacif. Sci.*, 15 (4).
- DAKIN, W. J., I. BENNETT and E. POPE, 1952. *Australian Seashores*. Angus & Robertson, Sydney.
- GANAPATI, P. N., and D. V. SUBBA RAO, 1959. Notes on the Feeding Habits of *Ianthina janthina* Linnaeus. *J. Mar. Biol. Ass. India*, 1, (2).
- LAURSEN, D., 1953. The genus *Ianthina*. *Dana Rep.*, 38.
- IREDALE, T., and D. F. McMICHAEAL, 1962. A Reference List of the Marine Mollusca of New South Wales. *Mem. Aust. Mus.*, 11.
- MACPHERSON, J. H., and C. J. GABRIEL, 1962. *Marine Molluscs of Victoria*. Melbourne University Press and the National Museum of Victoria, Melbourne.
- MAY, W. L., 1958. *An Illustrated Index of Tasmanian Shells* (Revised ed., by J. Hope Macpherson). Government Printer, Hobart.
- MORTON, J. E., 1954. The Pelagic Mollusca of the Benguela Current, Part 1. *Discovery Rep.*, 27.
- WILSON, D. P., and M. A. WILSON, 1956. A Contribution to the Biology of *Ianthina janthina* (L.). *J. Mar. Biol. Ass. U.K.*, 35:291-305, 2 figs., pl. 1.

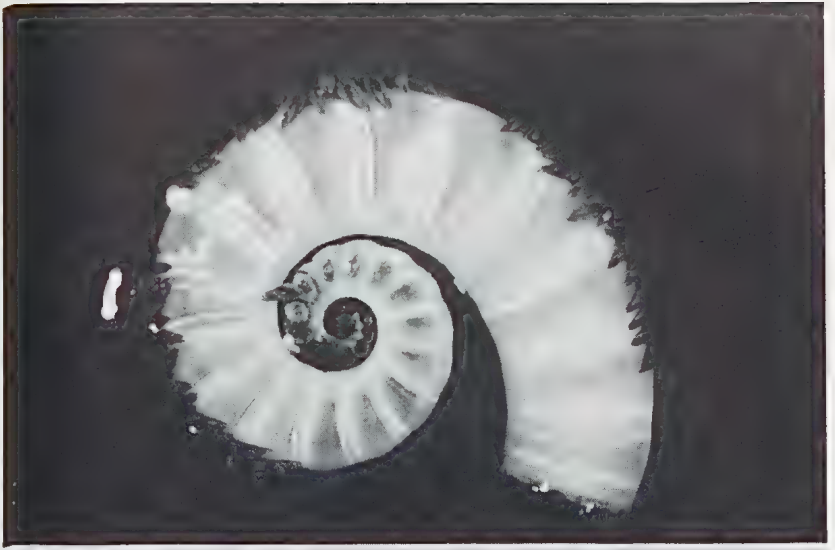


PLATE 13

- (1) Shell of *Spirula spirula* with newly attached post-cyprid stages of *Lepas pectinata*. Washed ashore Lord Howe Island, May, 1964.

Photograph: Mr. Justice Myers.

- (2) *Glaucus atlanticus*—undersurface of animal showing foot. Washed ashore on a Sydney beach.

Photograph: Keith Gillett.